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Contribution from the Bureau of Entomology, L. O. Howard, Chief.

## THE CATALPA SPHINX.[1]

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### INTRODUCTION.

Our native species of catalpa, the common or eastern catalpa[2] and the hardy or western species,[3] are comparatively free from insect attack. Such common shade-tree pests as the bagworm[4] and fall webworm[5] occasionally feed upon the leaves, but apparently do so only in the absence of food more palatable to them. There is one insect, however, the larva or caterpillar of the catalpa sphinx (fig. 1, *b*, *c*, *e*, *f*, *h*),[1] which feeds normally and exclusively on the foliage of these trees and in some seasons does very considerable injury, often completely stripping the leaves from individual trees and sometimes from an entire grove. (Fig. 2.) Owing doubtless to the increased planting of these trees outside the regions in which they are found in the wild state, this insect has extended its natural range, and its injury is more widespread now than formerly.

### DESCRIPTION.

The catalpa sphinx in its active feeding stage is a caterpillar fully 3 inches in length. It is very variable in color, there being a light and a dark form, as in the case of some related species. The prevailing colors are yellow and black, and this, combined with the large size of the insect, makes it a conspicuous object on infested trees. The complete life history by stages or periods of growth is well illustrated in figure 1.

[1] *Ceratomia catalpae* Bdv.; order Lepidoptera, family Sphingidae. [2] *Catalpa catalpa*. [3] *Catalpa speciosa*. [4] *Thyridopteryx ephemeraeformis* Haw. [5] *Hyphantria cunea* Dru.

NOTE.—This bulletin is of interest throughout the United States wherever catalpa trees occur.

FIG. 1.—Catalpa sphinx (*Ceratomia catalpae*): *a*, Egg mass; *b*, *b*, newly hatched larvæ; *c*, larva one-third grown; *d*, dorsal view of joint of *c*; *e*, *f*, two differently marked, nearly full-grown larvæ; *g*, dorsal view of joint of *f*; *h*, full-grown dark larva; *i*, dorsal view of joint of same; *j*, pupa; *k*, moth; *l*, egg, enlarged. All natural size, except *l*. Marx del.

The parent of the caterpillar is a large grayish-brown hawk moth, marked as shown in figure 1, *k*. It has a large, heavy body and powerful wings which measure 3 inches from tip to tip when spread. It lays its eggs in masses, in which respect it differs from other hawk moths. An egg mass is shown in the illustration at *a* and an individual egg at *l*. The young caterpillars are lighter colored than the mature ones, being pale yellow. Two striking variations of the larva

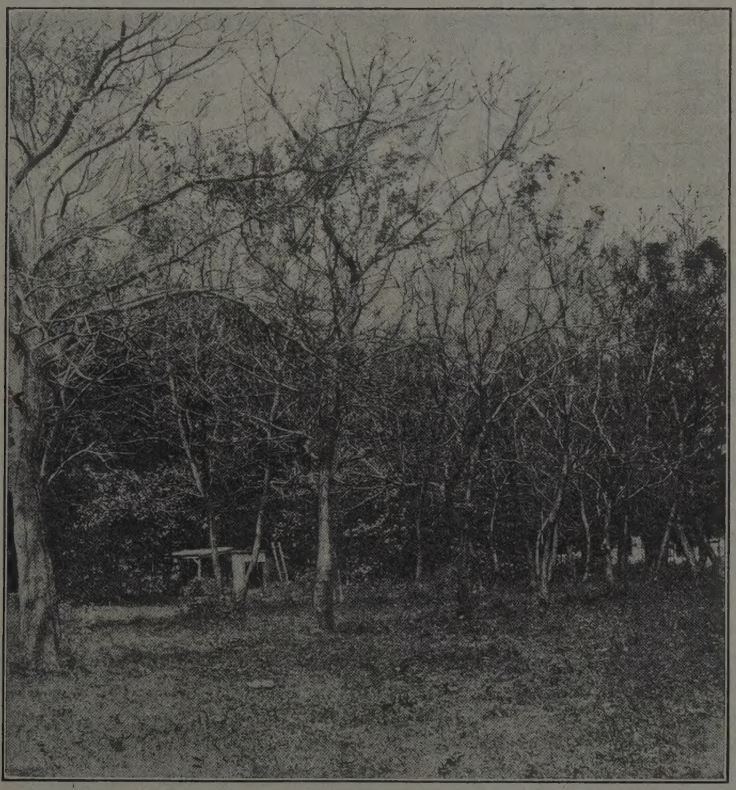

FIG. 2.—Catalpa trees showing excessive defoliation by the catalpa sphinx. (Original.)

in the later stages are shown at *f* and *e*, while *h* represents the commonest dark form of caterpillar. The larvæ have a stout black horn near the hind end of the body.

## ORIGINAL HOME AND PRESENT DISTRIBUTION.

The known distribution of the catalpa sphinx at the present time (1915) is shown in figure 3. This insect is strictly a North American

species, and its range was given in 1888 as from "Virginia to Florida; westward to the Mississippi; as far north as Indiana." It is common in Virginia, Maryland, and Ohio, and of late years it has extended its range northward on the Atlantic coast and has been received from several localities in southeastern Pennsylvania, New Jersey, Ohio, Kentucky, and Delaware. It has spread northward in Delaware and has greatly increased in numbers where it was formerly rare. Its northward range appears to be limited in the West by Illinois.[1] This species was observed in Alabama in 1883, was received from Denison, Tex., in 1889, and was reported from Arkansas in 1900. By 1906 it had become established at Elberon and Bloomfield, N. J., the latter, westward and a little north of New York City, being the northernmost point of which we have knowledge of its occurrence in the East. It has since been reported from Burlington, N. C., Jericho Springs, Mo., and Wetmore, Tenn.

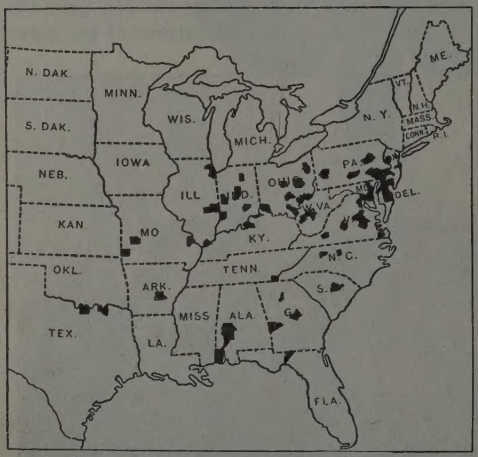


FIG. 3.—Map showing the known distribution of the catalpa sphinx in the United States in 1915. (Original.)

## LIFE HISTORY AND HABITS.

The catalpa sphinx is subject to considerable fluctuation in numbers. For one, two, or even several years it will not be seen in a given locality and will then suddenly appear in large numbers, completely defoliating the trees and covering the ground beneath with larval excreta. It is interesting to observe that John Abbot, who collected the type specimens in Georgia, mentioned the fact more than a hundred years ago that fishermen who inhabited the borders of the swamps hunted for these larvæ as the best bait for catching fish, and

[1] The range of its food plants is as follows: From the Gulf of Mexico in western Florida, and on the rivers in Alabama and Georgia, westward and northward along the Mississippi and its southern tributaries in the great delta formation to above the mouth of the Ohio; thence up the Wabash and White rivers of Indiana to near Vincennes. This was formerly taken by entomologists to indicate also the range of the catalpa sphinx. Published records, however, were lacking until recently to show its general occurrence west of Florida and Georgia along the gulf.

it is said that this bait is so esteemed for this purpose in some parts of Florida that the catalpa is often cultivated for no other purpose than to attract the insect.

The eggs, as has been stated, are laid in masses, and the young larvæ feed in groups for some time. The capacity of the species for multiplying may be judged from the fact that an egg mass in the collection of the United States National Museum contains nearly 1,000 eggs. The mass is not compact, however, and is but slightly fastened to the underside of the leaves. Sometimes the eggs are laid in smaller masses on the stems and branches. The larvæ molt four times, becoming variable in their markings as they grow older. In the extreme South the insect is reported as being found in all stages during the summer, and there are three or four generations a year, the last generation wintering in the pupal stage beneath the ground and giving forth the moths the following March. In the summer, according to observations made in Florida, the time occupied by a complete generation is about six weeks. Around Washington, D. C., at Coalburg, W. Va., and probably everywhere in its southern range, there are two generations annually.

## NATURAL ENEMIES.

A number of parasitic insects attack and kill the catalpa sphinx. *Apanteles congregatus* Say, a common, widespread, and very general parasite of sphinx caterpillars throughout the eastern United States, attacks this species quite as freely as it does the hornworms of tobacco and tomato. Unfortunately, this parasite is in turn attacked by other parasites, two species of which[1] are recorded. These last, fortunately, do not seem to be generally abundant, hence the beneficial parasite flourishes in spite of their attacks. *Apanteles congregatus* is a minute, four-winged, wasplike insect which lays its eggs in the sphinx caterpillar. Its larvæ—white, maggotlike creatures—develop within the body of the caterpillar, and when full fed and ready for transformation each individual eats a hole through the skin of the caterpillar and spins its little white cocoon on the outside. Two hundred or more such cocoons may be seen on the body of a single caterpillar. After a few days the winged parasites issue from the cocoons to lay eggs and produce another generation of larvæ.

(*Apanteles*) *Microplitis catalpae* Riley, which appears to be especially a parasite of the genus to which the catalpa sphinx belongs, is also an enemy of this species, although, like the Apanteles, it is sometimes itself attacked by other parasites.[2]

[1] *Mesochorus aprilinus* Ashm. and *Hemiteles mesochoridis* Riley MS.

[2] *Hypopteromalus tabacum* Fitch and (*Holcopelte*) *Horismenus microgastri* Ashm.

Two common species of tachina flies[1] attack the larva of the catalpa sphinx. These are general parasites of butterflies and moths, the former infesting 27 distinct species, the latter 22.

A few birds prey upon the caterpillar, but most of them evidently find it when full grown a rather tough morsel, the skin being especially thick and resistant and the insect a very muscular one, so that, in fact, it is difficult to crush one with the end of a cane. Among the birds which have been recorded as destroying this insect are cuckoos, the catbird, and the Baltimore oriole.

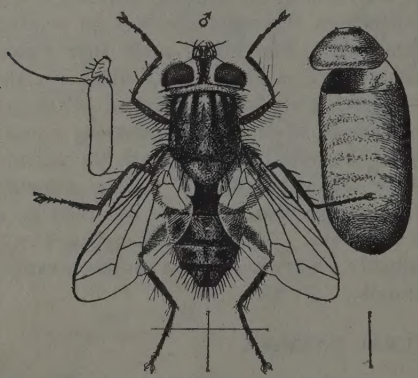

FIG. 4.—One of the tachina flies, *Phorocera claripennis*, a parasite of the catalpa sphinx: Adult with puparium at right and enlarged antenna at left. (From Howard.)

## REMEDIES.

There are several methods by which the catalpa sphinx may be readily destroyed. The caterpillars may be gathered by hand, the foliage of the trees may be sprayed with arsenical poisons, the pupæ may be destroyed by spading the ground around the tree trunks in the fall, and, indirectly, the sphinx may be destroyed by protecting the parasitic insects which attack it.

### HAND PICKING.

Owing to its large size, the caterpillar is easily seen and can be controlled by hand picking. In the case of large trees a long ladder and a 12-foot pole pruner or similar device will be necessary in this work.

### SPRAYING WITH ARSENICALS.

Where the caterpillars are injurious to trees of considerable height, rendering hand picking difficult, or where they occur in such abundance as to render probable the complete defoliation or stripping of the tree, the application of an arsenical spray is the best method for their control. Advantage may be taken of the gregarious habit of the young caterpillars by watching rather closely for their appearance in the spring, and if the leaves are observed to be eaten in any particular place, promptly applying an arsenical spray.

The arsenicals ordinarily used in the control of shade-tree insects are arsenate of lead and Paris green. If properly applied, neither of

[1] *Phorocera claripennis* Macq. (fig. 4) and *Frontina frenchii* Will.

these will be injurious to the leaves. In the preparation of these materials for spraying, the desired quantity of the chemical, usually 1 pound of Paris green or 3 pounds of arsenate of lead to 50 gallons of water, is weighed out and thoroughly mixed in a pail or other small container with a gallon or two of water. This mixture is then poured into a 50-gallon barrel, the remainder of the water added, and after having been strained through fine copper gauze for the removal of particles which might clog the nozzles, the spray is ready for use.

The application of the arsenate of lead or Paris green spray in combination with Bordeaux mixture is desirable, since the foliage of the catalpa is frequently infected by leaf spot[1] and by other similar diseases which may be controlled by the application of Bordeaux mixture. Moreover, in the presence of Bordeaux mixture no burning is likely to result, even to the most delicate foliage, through free arsenic in the Paris green or arsenate of lead used in the spray mixture. Bordeaux mixture may be prepared for this purpose as follows: In a barrel containing 25 gallons of water hang 6 pounds of blue vitriol or bluestone in a cloth sack. Four pounds of fresh stone lime should then be slaked in a pail or other container and water added until of about the consistency of whitewash. This mixture should then be poured into a second barrel with 25 gallons of water. In the usual preparation of spray mixtures 50-gallon barrels are used. After the bluestone has dissolved and the lime has been added to its respective quantity of water the two barrels may then be raised and simultaneously poured into a third one, the mixture being well stirred at the same time. After the preparation of the Bordeaux mixture according to this formula the requisite amount of Paris green or arsenate of lead is added and thoroughly stirred into the mixture.

A sprayer suitable for the control of the catalpa sphinx caterpillar, or other larvæ feeding on the leaves of catalpa or other trees of similar size and habit, might consist of one of the smaller power outfits such as are used in orchard spraying, or one of the large double-action hand pumps capable of furnishing a spray mixture to from three to five nozzles of the removable steel-disk type, using the large opening, at about 100 pounds pressure.

With the aid of a 10 to 12 foot tower on the wagon and an extension rod on the hose line, it will be possible to treat trees from 35 to 40 feet in height, which is about the maximum for the ordinary catalpa under cultivation. For trees of greater height a three-eighths to one-fourth inch nozzle of the Worthley type, supplied by a pump capable of delivering from 30 to 50 gallons a minute at a pressure of from 300 to 400 pounds, will be found necessary. Trees as much as 100 feet in

[1] *Phyllosticta catalpæ.*

height have been sprayed in this manner from an ordinary sprayer tower. A high-power spraying outfit of the type used against the gipsy moth is shown in figure 5. Such a powerful stream will dis-

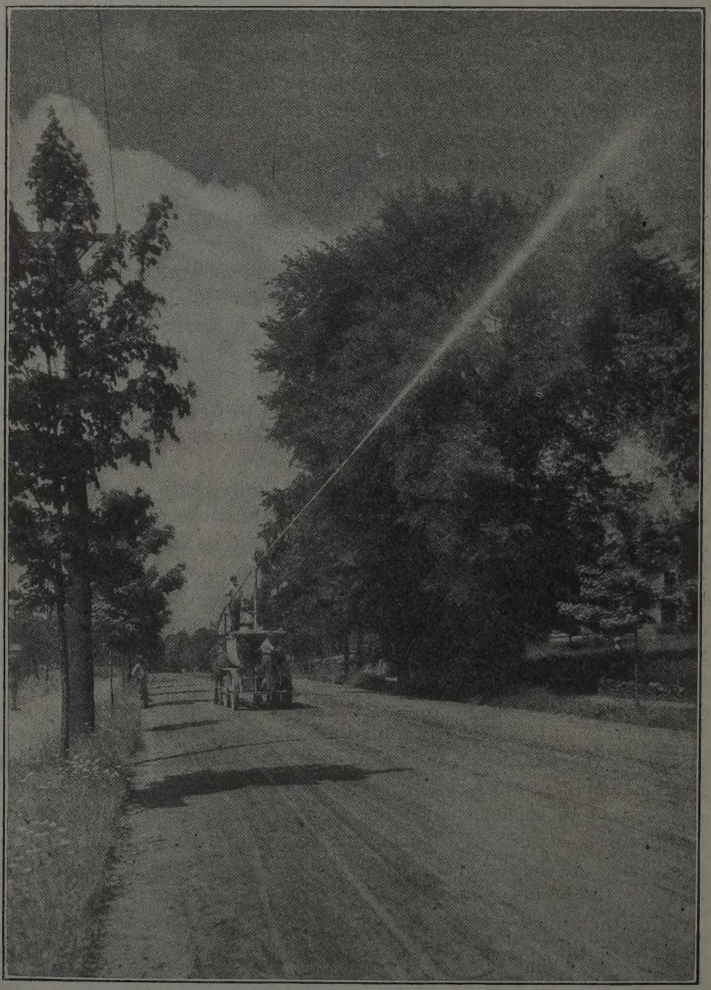

FIG. 5.—High-power spraying outfit for treating large caterpillars like the gipsy moth and catalpa sphinx. (From Burgess and Rogers.)

lodge many of the caterpillars. Particular attention is called to the upper end of the stream, in the illustration, where it breaks into a mistlike spray.

### DESTRUCTION OF THE PUPÆ.

Where the caterpillars have been so abundant as to affect the trees, it will pay as a precaution for the following year to spade up the ground thoroughly and disintegrate it in the fall so as to destroy the pupæ, which will be found concentrated under the surface of the ground in the immediate vicinity of the trunk.

### PROTECTING THE PARASITES.

The second or last generation, which appears in September and October, is largely destroyed by parasites which are frequently very abundant just as the oldest caterpillars are beginning to reach full growth. At this time the parasites, which have been previously mentioned, issue from the bodies of their host and spin large masses of white cocoons on the backs of the caterpillars. These masses are so large that they can be seen at a considerable distance against the black stripes of the host insect. It is not advisable to destroy the caterpillars at this stage, as the parasites are very beneficial and in ordinary seasons will reduce the numbers of the sphinx caterpillars so that they will not do much harm the following season. Where the caterpillars can be easily gathered it will pay to pick them from the leaves and transfer them to barrels or large boxes covered with wire netting. This will prevent the caterpillars from issuing or falling a prey to birds or other animals, and will insure the issuance of the parasites through the meshes, thus encouraging their good work. A few holes should be bored in the bottom of the barrels or boxes used, small enough to prevent the caterpillars from crawling through them into the ground. This will prevent the accumulation of water after rains, which might drown the insects or set up putrefaction in the mass.

### COÖPERATION.

If the cooperation of neighbors who have catalpa trees growing on their premises can be secured, this caterpillar can be largely controlled for several years in succession.

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